PATENT ABSTRACTS OF JAPAN

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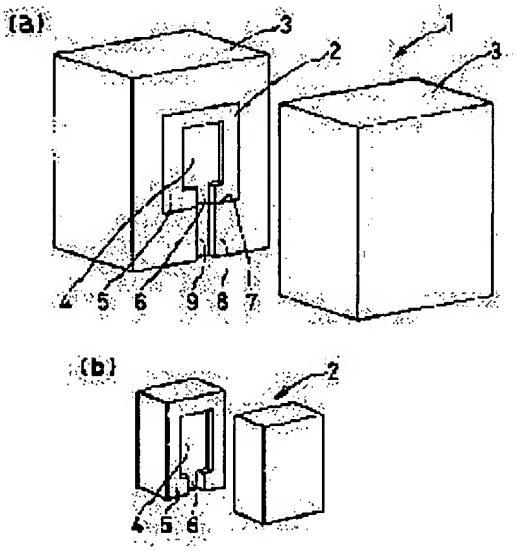
(54) DIE TO BE USED FOR DIE CASTING OF CAST IRON

(57)Abstract:

PROBLEM TO BE SOLVED: To produce a formed body which is not cracked easily by using a composite die comprising a graphite die to form a cavity and a die to reinforce the graphite die as a die-casting die of cast iron to greatly reduce the thermal load of the die and suppress generation of the cementite structure in the die casting.

SOLUTION: A die for die-cast injection molding basically comprises a graphite die 2 and a die 3. A cavity 4 is formed to the shape of a formed body inside the graphite die 2, and a runner 6 to be communicated with the cavity 4 is provided in a mating surface of the graphite die 2. The outer contour of the graphite die 2 is approximately of parallelepiped. The die 3 is made of the metal such as steel and copper, the graphite die 2 is inserted therein, a recess 7 to reinforce the graphite die 2 is provided, and a runner 9 to be communicated with the runner 6 formed in the mating surface 5 of the graphite die 2 is provided.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Mold which is the mold used for die casting of the cast iron which injects, carries out pressurization maintenance and fabricates cast iron to mold, and is used for die casting of the cast iron characterized by mold consisting of metal mold which backs up graphite mold and this graphite mold.
[Claim 2] Mold with which graphite mold is used for die casting of the cast iron according to claim 1 which it comes to prepare in a part.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the mold used for die casting of cast iron.
[0002]
[Description of the Prior Art] Although there is a thing of various gestalten, such as a horizontal type and a vertical mold, in a die-casting facility, the basic configuration consists of injection equipment 11 and metal mold 12 like the vertical mold die-casting facility shown in drawing 6 with a schematic diagram, and injection equipment 11 is equipped with the injection cylinder 13, a plunger 14, and the injection sleeve 15, and, as for metal mold 12, the product cavity 16 is formed. And die casting usually carries out teeming of the molten metal 17 to the injection sleeve 15 using said facility, after advancing metal mold 12 to this injection sleeve 15 and setting to it, the advance drive of the plunger 14 is carried out, while injecting a molten metal 17 in a cavity 16, predetermined time pressurization maintenance is carried out, after an appropriate time, metal mold 12 is retreated, a product is taken out and die casting is performed.
[0003] In the above-mentioned die casting, with the aluminium alloy or the Magnesium alloy, since a molten metal 17 is a metal with the comparatively low melting point, it has already been widely used using the metal mold 12 fabricated with die steel, heat-resisting steel, etc. Moreover, the CHIKUSO cast method which heats and carries out die casting of the alloy material (billet) to a solid-liquid coexistence temperature region is also put in practical use. However, about die casting using cast iron as a molten metal 17, although developed and proposed by a Japanese Patent Publication No. 52-No. 447 official report, JP,52-125422,A, the Provisional-Publication-No. 53-No. 61520 official report, the Provisional-Publication-No. 53-No. 95118 official report, etc., for example, it has not resulted in utilization that the thermal load to metal mold is large, and a life is short owing to.
[0004] For this reason, although, as for manufacture of a cast iron casting, metal mold is partly used in the gravity casting of cast iron, most is a sand cast and current is a problem with very serious environmental problems, such as aggravation of the work environment accompanying use of molding sand, and processing of waste sand. Moreover, in the gravity casting using said metal mold, although an environmental problem like molding sand is solved, since it is casting by the molten metal, it is thought that the thermal load of metal mold is considered to be quite large, and a problem is in a mold life although it is not die casting to which high pressure is applied.
[0005] On the other hand, although it is strong and is in the inclination of toughness and high-intensity-izing also in the cast industry, since gravity casting is a subject as mentioned above in cast iron, the needs of lightweight-izing including an automobile are thickness. About 3mm is the limitation of thinning, and if the light-gage casting of the thickness not more than it is not pressure die casting, it is difficult. However, die casting by molten iron does not result in utilization as mentioned above, and has quenching by metal mold with a light-gage casting technically, and the crack by thermal stress etc. tends to produce it.
[0006] moreover, on the other hand, there is a proposal of the LEO cast method for injecting the cast iron slurry of a solid-liquid coexistence temperature region into a direct die-casting sleeve or the CHIKUSO cast method which is alike, and heats and carries out die casting of the cast iron material (billet) to a solid-liquid coexistence temperature region recently (for example, reference, such as a publication-number 5 No. -43978 official report, a publication-number 6 No. -106321 official report, and a publication-number 7 No. -204820 official report). Since injection of pressure die casting like this LEO cast method or the CHIKUSO cast method is possible at low temperature from a molten metal, it can mitigate the thermal load to metal mold, and attracts attention.
[0007]
[Problem(s) to be Solved by the Invention] However, although injection temperature is injected at temperature lower than molten iron, it is 1100 degrees C or more and an elevated temperature, and even if it makes it die casting like the

LEO cast method or the CHIKUSO cast method, since it turns to high pressure up, the thermal load to metal mold is a problem greatly as before. since [moreover,] it quenches within [other than the thermal load of this metal mold] metal mold -- iron-cementite system coagulation -- being generated -- being easy -- since the cementite organization where a degree of hardness is high generates, and it is easy to produce a crack for a die-casting product and especially quenches with a light-gage casting -- being divided -- easy -- that preventive measure -- the front face of mold goods -- an improvement of description serves as an important technical problem.

[0008] Then, this invention is made in order to cancel the trouble like ****, and the purpose offers the mold used for die casting of cast iron which controls generation of the cementite organization under die casting, and can manufacture a cast iron product with few cracks while being able to mitigate the thermal load to metal mold sharply.

[0009]

[Means for Solving the Problem] The mold used for die casting of the cast iron concerning this invention in order to attain the above-mentioned purpose is mold used for die casting of the cast iron which injects, carries out pressurization maintenance and fabricates cast iron to mold, and consists of metal mold with which mold backs up graphite mold and this graphite mold.

[0010] And in the mold used for die casting of the cast iron concerning above-mentioned this invention, graphite mold may be formed in the part.

[0011] Hereafter, an operation is explained to the configuration list of this invention at a detail. Although it will be based also on the quality of the material of metal mold, and a gating system plan if molten iron, such as a slurry of a molten metal or a solid-liquid coexistence temperature region, is injected in metal mold like before, in immediately after, it is the skin temperature. It amounts to 400-500 degrees C or more. Therefore, temperature distribution are produced in metal mold, and it pulls in connection with thermal expansion, or compressive stress acts, and if they exceed the reinforcement of metal mold, it will result in destruction of metal mold. Moreover, a heat cycle will be received by generally carrying out continuous duty repeatedly, and it leads to generating of the crack by thermal fatigue. Usually, since metaled reinforcement falls with temperature, it is a reason which die casting of a refractory metal does not realize.

[0012] This invention is a thing using the carbon material (graphite) with which a coefficient of thermal expansion is comparatively small, and reinforcement does not fall to the metal mold inside from which a molten metal contacts directly and serves as an elevated temperature as mentioned above at an elevated temperature, either. While being able to suppress the temperature rise (thermal load) of metal mold and being able to aim at large improvement in a life by this Quenching of the molten iron injected by the cavity is eased, and generation of the cementite organization under die casting is controlled, and can obtain a cast product with few cracks, and also Problems of graphite mold which can cast even if a mold-release characteristic is good and it does not use a release agent since it is hard to get wet in molten iron etc., and arise conventionally in the case of metal mold, such as printing and contamination of a release agent, are lost. Moreover, since metal mold sticks to the outside of graphite mold and it is prepared, the welding pressure applied to graphite mold at the time of die casting can be backed up, it is stabilized and a cast product with few said cracks can be manufactured.

[0013] in order to acquire the above-mentioned operation effectively -- thickness of graphite mold about 2-10mm is desirable -- less than 2mm and in being thin, it loses the semantics which the thermal load to metal mold became large, and prepared the graphite, and also handling takes cautions that it is easy to damage graphite mold. Moreover, by the thickness exceeding 10mm, while the thermal load to metal mold is small, temperature control, such as a molten metal, becomes difficult and the productivity of die casting is affected.

[0014] On the other hand in the metal-mold-casting process by gravity casting Although it is difficult for the contact situation between the molten metals and metal mold which were poured in to worsen in connection with solidification shrinkage, and for thermal resistance to increase rapidly, and to control this, in this invention according to the high-pressure force in the case of die casting, and an operation of graphite mold Such thermal resistance is comparatively small and can control the cooling rate of control, i.e., coagulation, and mold goods for a heat flow rate by setting up appropriately the quality of the material of the graphite used as mold, and configurations (thickness etc.). Moreover, although a heat flow rate changes locally with configurations of mold goods, the thermal load to metal mold can be equalized by selecting the quality of the material of a graphite, and a configuration appropriately.

[0015] Moreover, one of the descriptions of die casting is that shaping of the product which has a thin-walled part is attained. However, like especially cast iron, with a ductile small ingredient, the reinforcement of a thin-walled part may be low and may produce a crack with thermal stress during cooling. In the boundary section of a thin-walled part and a heavy-gage part, it is especially easy to generate big thermal stress by the difference in a cooling rate. In this invention, as mentioned above, a heat flow rate can be controlled by designing graphite mold of this part appropriately, and the

healthy mold goods which the relaxation of thermal stress of is attained and do not have a crack defect in a thin-walled part or the boundary section are obtained.
[0016]
[Embodiment of the Invention] Hereafter, the gestalt of operation concerning this invention is explained with reference to a drawing. Drawing 1 is the explanatory view of the mold concerning this invention, and the whole mold perspective view which a requires for this invention, and b are the perspective views of the graphite mold concerning this invention.
[0017] The mold 1 concerning this invention consists of graphite mold 2 and metal mold 3 fundamentally, and a cavity 4 is fabricated according to the configuration of a cast iron product inside the graphite mold 2, and the runner 6 which is open for free passage to a cavity 4 is fabricated by the mating face 5 of the graphite mold 2. Moreover, the appearance of the graphite mold 2 is fabricated in general by the rectangular parallelepiped.
[0018] On the other hand, the hollow 7 for metal mold 3 consisting of metals, such as steel and copper, making the graphite mold 2 insert in the interior, and backing up is formed, and the runner 9 which is open for free passage to the runner 6 fabricated to the mating face 5 of the graphite mold 2 is established in the mating face 8 of metal mold 3.
[0019]
[Example]
[Example 1] Width of face which the mold 1 shown in the vertical mold die-casting facility shown in drawing 6 at above-mentioned drawing 1 is set (thickness of the graphite mold 2 at this time it could be 5mm), and carries out die casting using molten iron (3.09%C-2.01%Si) and which is shown in drawing 2 100mmx height 150mmx thickness The 6.3mm tabular product was manufactured. And it sets in this manufacture process and is from the internal surface of metal mold 3. The temperature in metal mold under die casting was measured with K thermocouple embedded in the location of 0.6mm. Moreover, die casting of the tabular product of this dimension was carried out in this way only with metal mold (SKD61) for the comparison. Drawing 3 shows the temperature measurement result of the temperature in metal mold of a condition [having injected to metal mold]. Moreover, drawing 4 shows the temperature change when injecting repeatedly. Moreover, drawing 5 shows mold goods with the crack acquired by metal mold (example of a comparison).
[0020] Only in the case of metal mold, internal-surface temperature so that more clearly than drawing 3 and drawing 4 500 degrees C is exceeded, the metal mold quality of the material deteriorates by using it for a long time, and being cracked and damaged is expected. Moreover, possibility that a crack will arise as shown in mold goods at drawing 5 is high. On the other hand, in the case of the mold 1 concerning this invention, it is the internal-surface temperature of metal mold 3. It was changing below 300 degrees C, and use of long duration is possible by exchanging the graphite mold 2, and the crack was not accepted in mold goods. In addition, it is possible by choosing appropriately the dimension of the graphite mold 2, a configuration, and the graphite quality of the material, and cooling metal mold 3 in this invention, to lower a die temperature further, without hardly affecting cooling of mold goods.
[0021] In addition, it is what explained the example by the molten metal method which used molten iron with the highest temperature in the above-mentioned example, and the application to die casting by the LEO cast method temperature is lower than a molten metal method, or the CHIKUSO cast method is possible enough.
[0022]
[Effect of the Invention] As explained above, according to the mold used for die casting of the cast iron concerning this invention, the thermal load to metal mold can be mitigated sharply, and, as for molten iron, die casting of the cast iron by the LEO cast method or the CHIKUSO cast method becomes possible from origin. Moreover, a graphite is cheap, machining is easy, and since a graphite is prepared in the location which the thermal load of metal mold requires and a cavity is formed, while the life of expensive metal mold is made for a long time, reduction of metal mold classes can be aimed at. Moreover, generation of the cementite organization under die casting can be controlled, and a cast iron product with few cracks can be manufactured.

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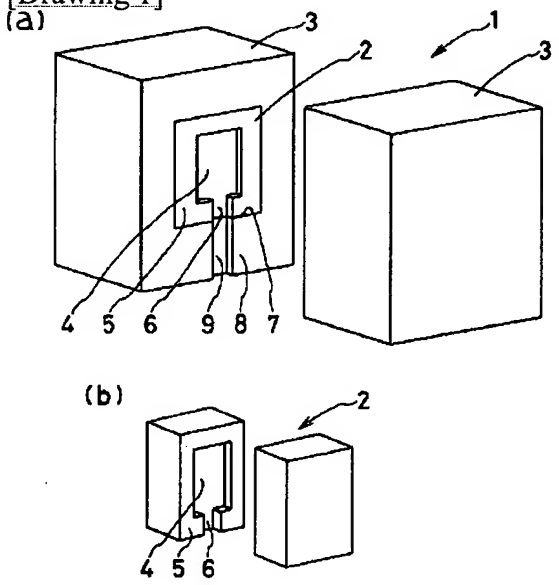
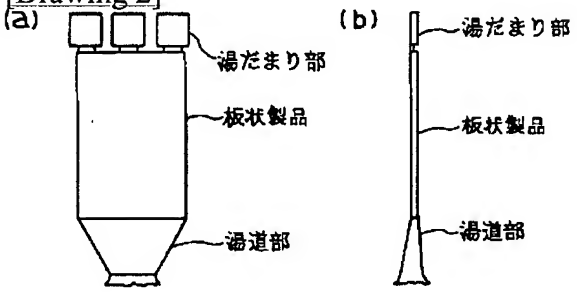
DRAWINGS

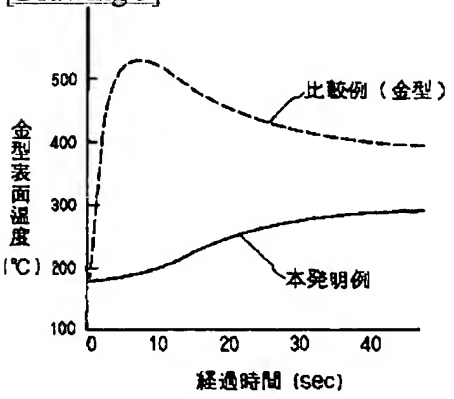
[Drawing 1]



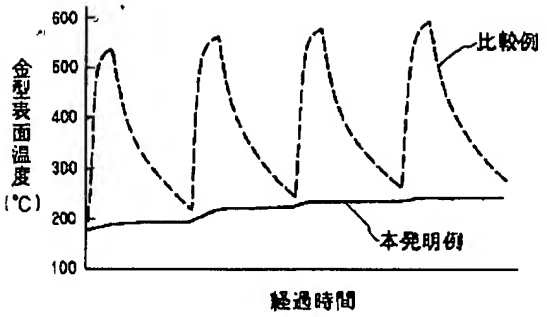
[Drawing 2]



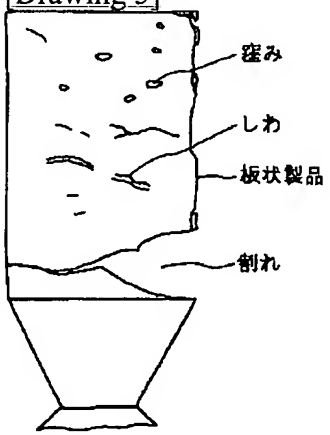
[Drawing 3]



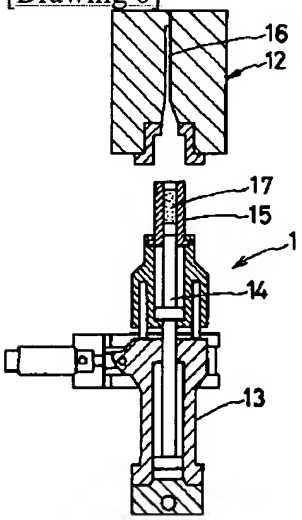
[Drawing 4]



[Drawing 5]



[Drawing 6]



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EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

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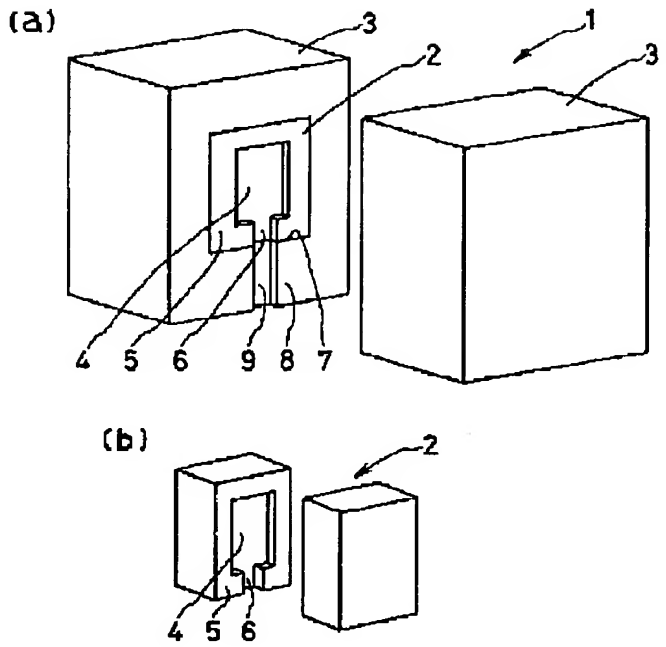
APPLICANT : KOBE STEEL LTD;

INVENTOR : ANDO YUICHI;

INT.CL. : B22D 17/22

TITLE : DIE TO BE USED FOR DIE CASTING OF CAST IRON



ABSTRACT : PROBLEM TO BE SOLVED: To produce a formed body which is not cracked easily by using a composite die comprising a graphite die to form a cavity and a die to reinforce the graphite die as a die-casting die of cast iron to greatly reduce the thermal load of the die and suppress generation of the cementite structure in the die casting.

SOLUTION: A die for die-cast injection molding basically comprises a graphite die 2 and a die 3. A cavity 4 is formed to the shape of a formed body inside the graphite die 2, and a runner 6 to be communicated with the cavity 4 is provided in a mating surface of the graphite die 2. The outer contour of the graphite die 2 is approximately of parallelepiped. The die 3 is made of the metal such as steel and copper, the graphite die 2 is inserted therein, a recess 7 to reinforce the graphite die 2 is provided, and a runner 9 to be communicated with the runner 6 formed in the mating surface 5 of the graphite die 2 is provided.

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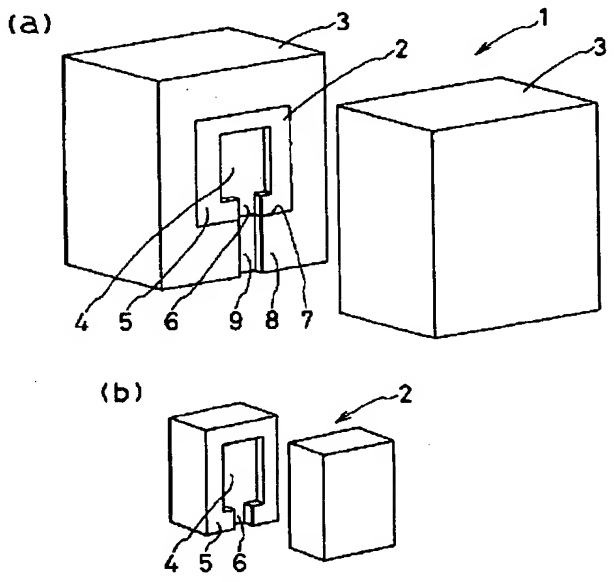
(54)【発明の名称】　鋳鉄のダイカストに用いられる鋳型

(57)【要約】

【課題】　金型に対する熱負荷を大幅に軽減し得るとともに、ダイカスト中のセメンタイト組織の生成を抑制して割れの少ない鋳鉄製品を製造し得る、鋳鉄のダイカストに用いられる鋳型を提供する。

【解決手段】　鋳鉄を鋳型に射出し加圧保持して成形する鋳鉄のダイカストに用いられる鋳型であって、鋳型１が黒鉛鋳型２とこの黒鉛鋳型２をバックアップする金型３よりなる。



【特許請求の範囲】
【請求項１】　鋳鉄を鋳型に射出し加圧保持して成形する鋳鉄のダイカストに用いられる鋳型であって、鋳型が黒鉛鋳型とこの黒鉛鋳型をバックアップする金型よりなることを特徴とする鋳鉄のダイカストに用いられる鋳型。
【請求項２】　黒鉛鋳型が一部に設けられてなる請求項１記載の鋳鉄のダイカストに用いられる鋳型。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、鋳鉄のダイカストに用いられる鋳型に関するものである。
【０００２】
【従来の技術】ダイカスト設備には横型や縦型など種々の形態のものがあるが、その基本構成は、例えば図６に概要図で示す縦型ダイカスト設備のように、射出装置11と金型12とで構成され、射出装置11は射出シリンダ13、プランジャ14、射出スリーブ15を備え、また金型12は製品キャビティ16が形成されている。そして、ダイカストは、前記設備を用い、射出スリーブ15に通常溶湯17を注湯し、この射出スリーブ15に金型12を前進させてセットした後、プランジャ14を前進駆動させて溶湯17をキャビティ16内に射出するとともに所定時間加圧保持し、しかる後、金型12を後退させ製品を取り出しダイカストが行われる。
【０００３】上記ダイカストにおいて、溶湯17がアルミニウム合金やマグネシウム合金などでは、比較的融点の低い金属であることからダイス鋼や耐熱鋼などで成形した金型12を用い既に広く実用されている。また、合金素材（ビレット）を固液共存温度域に加熱してダイカストするチクソキャスト法も実用化されている。しかし、溶湯17として鋳鉄を用いるダイカストについては、例えば特公昭52－ 447号公報、特開昭52－125422号公報、特開昭53－ 61520号公報、特開昭53－ 95118号公報等に開発・提案されているものの、金型に対する熱負荷が大きく寿命が短いことが原因で実用化には至っていない。
【０００４】このため、鋳鉄鋳物の製造は、鋳鉄の重力鋳造において一部で金型が用いられているものの、現在でもほとんどが砂型鋳造であり、鋳物砂の使用に伴う作業環境の悪化、廃砂の処理など、環境問題は非常に深刻な問題である。また、前記金型を用いた重力鋳造では、鋳物砂のような環境問題は解消されるものの、溶湯による鋳造であるため、金型の熱負荷は高圧をかけるダイカストほどではないが、かなり大きいと考えられ金型寿命に問題があるものと思われる。
【０００５】一方、自動車をはじめとして軽量化のニーズは強く、鋳物業界においても強靭、高強度化の傾向にあるが、鋳鉄では、上述のように重力鋳造が主体であるため厚さ 3㎜程度が薄肉化の限界であり、それ以下の厚みの薄肉鋳物はダイカスト法でないと難しい。しかし、鋳鉄溶湯によるダイカストは上述のように実用化には至っておらず、また技術的には薄肉鋳物では金型による急冷があり熱応力などによる割れが生じやすい。
【０００６】また一方、最近、固液共存温度域の鋳鉄スラリーを直接ダイカストスリーブに注入するレオキャスト法、あるいはに、鋳鉄素材（ビレット）を固液共存温度域に加熱してダイカストするチクソキャスト法の提案がある（例えば、特開平 5－43978号公報、特開平 6－106321号公報、特開平 7－204820号公報等参照）。このレオキャスト法やチクソキャスト法のようなダイカスト法は、溶湯より低温で射出ができることから金型に対する熱負荷が軽減でき注目されている。
【０００７】
【発明が解決しようとする課題】しかしながら、レオキャスト法やチクソキャスト法のようなダイカストにしても、射出温度は鋳鉄溶湯よりは低い温度で射出するものの、1100℃以上と高温である上に高圧になることから金型に対する熱負荷は以前として大きく問題である。また、この金型の熱負荷のほかに、金型内で急冷されるため鉄－セメンタイト系凝固が生じやすくなり、硬度の高いセメンタイト組織が生成することからダイカスト製品に割れが生じやすく、とりわけ薄肉鋳物では急冷されることもあって割れやすく、その防止策と共に成形品の表面性状の改善が重要な課題となる。
【０００８】そこで、本発明は、上述のごとき問題点を解消するためになしたものであって、その目的は、金型に対する熱負荷を大幅に軽減し得るとともに、ダイカスト中のセメンタイト組織の生成を抑制して割れの少ない鋳鉄製品を製造し得る、鋳鉄のダイカストに用いられる鋳型を提供するものである。
【０００９】
【課題を解決するための手段】上記の目的を達成するために、本発明に係る鋳鉄のダイカストに用いられる鋳型は、鋳鉄を鋳型に射出し加圧保持して成形する鋳鉄のダイカストに用いられる鋳型であって、鋳型が黒鉛鋳型とこの黒鉛鋳型をバックアップする金型よりなるものである。
【００１０】そして、上記本発明に係る鋳鉄のダイカストに用いられる鋳型においては、黒鉛鋳型が一部に設けられてあってもよい。
【００１１】以下、本発明の構成並びに作用について詳細に説明する。溶湯あるいは固液共存温度域のスラリー等の鋳鉄溶湯を従来のように金型内に射出すると、金型の材質、鋳造方案にもよるが、直後にはその表面温度は 400～500℃以上に達する。そのため金型内に温度分布を生じ、熱膨張に伴い引っ張りあるいは圧縮応力が作用し、それらが金型の強度を上回ると金型の破壊に至る。また、一般に繰り返し連続使用することで熱サイクルを受けることになり、熱疲労によるクラックの発生につながる。通常、金属の強度は温度とともに低下するので、

高融点金属のダイカストが実現しない所以である。

【００１２】本発明は、上記のように溶湯が直接接触し高温となる金型内面に、熱膨張係数が比較的小さく高温でも強度の低下しない炭素材料（黒鉛）を用いるもので、これにより、金型の温度上昇（熱負荷）を抑えることができ寿命の大幅な向上が図れるとともに、キャビティに射出された鋳鉄溶湯の急冷が緩和されダイカスト中のセメンタイト組織の生成が抑制され割れの少ない鋳物製品を得ることができる他、黒鉛鋳型は鋳鉄溶湯等とは濡れにくいため離型性がよく、離型剤を用いなくても成型でき従来金型の場合に起こる焼き付きや離型剤の巻き込みなどの問題がなくなる。また、黒鉛鋳型の外側には金型が密着して設けられているので、ダイカスト時に黒鉛鋳型にかかる加圧力をバックアップすることができ、前記割れの少ない鋳物製品を安定して製造することができる。

【００１３】上記作用を効果的に得るためには、黒鉛鋳型の厚みは 2～10㎜程度が望ましく、 2㎜未満と薄い場合には金型への熱負荷が大きくなり黒鉛を設けた意味が無くなる他、黒鉛鋳型が損傷しやすく取り扱いに注意を要する。また、10㎜を超える厚みでは、金型への熱負荷が小さい反面、溶湯等の温度制御が難しくなりダイカストの生産性に影響がでる。

【００１４】一方、重力鋳造による金型鋳造プロセスでは、注入された溶湯と金型との間の接触状況が凝固収縮にともなって悪くなり、熱抵抗が急激に増大し、これを制御することは難しいが、本発明ではダイカストの際の高圧力と黒鉛鋳型の作用により、これらの熱抵抗は比較的小さく、鋳型として使用する黒鉛の材質、形状（厚みなど）を適切に設定することにより、熱流を制御、すなわち、凝固及び成形品の冷却速度を制御できる。また成形品の形状によって局部的に熱流が異なるが、黒鉛の材質、形状を適切に選定することによって、金型への熱負荷を均一化できる。

【００１５】また、ダイカストの特徴のひとつが薄肉部を有する製品の成形が可能となることである。しかしながら、特に鋳鉄のように延性の小さい材料では、薄肉部の強度が低く、冷却中に熱応力で割れを生じることがある。特に薄肉部と厚肉部の境界部では冷却速度の違いにより大きな熱応力が発生しやすい。本発明では上述したようにこの部分の黒鉛鋳型の設計を適切に行うことにより、熱流を制御でき、熱応力の緩和が可能となり薄肉部や境界部での割れ欠陥のない健全な成形品が得られる。

【００１６】

【発明の実施の形態】以下、本発明に係る実施の形態を図面を参照して説明する。図１は、本発明に係る鋳型の説明図であって、ａは本発明に係る鋳型の全体斜視図、ｂは本発明に係る黒鉛鋳型の斜視図である。

【００１７】本発明に係る鋳型１は、黒鉛鋳型２と金型３とで基本的に構成され、黒鉛鋳型２の内部には鋳鉄製品の形状に合わせてキャビティ４が成形され、また黒鉛鋳型２の合わせ面５にはキャビティ４に連通する湯道６が成形されている。また黒鉛鋳型２の外形は概ね直方体に成形されている。

【００１８】一方、金型３は、鋼、銅等の金属からなりその内部には黒鉛鋳型２を装入せしめてバックアップするための窪み７が設けられ、また金型３の合わせ面８には黒鉛鋳型２の合わせ面５に成形した湯道６に連通する湯道９が設けられている。

【００１９】

【実施例】

〔実施例１〕図６に示す縦型ダイカスト設備に上記図１に示す鋳型１（この時の黒鉛鋳型２の厚みは 5㎜とした）をセットし、鋳鉄溶湯（3.09％Ｃ－2.01％Ｓｉ）を用いてダイカストし、図２に示す幅 100㎜×高さ 150㎜×厚さ 6.3㎜の板状製品を製作した。そして、この製作過程において金型３の内表面から 0.6㎜の位置に埋め込んだＫ熱電対によってダイカスト中の金型内温度を測定した。また、比較のため金型（ＳＫＤ６１）のみによって同寸法の板状製品を同要領でダイカストした。図３は金型に射出したままの状態の金型内温度の測温結果を示す。また図４は繰り返し射出したときの温度変化を示す。また図５は金型（比較例）によって得られた割れのある成形品を示す。

【００２０】図３及び図４より明らかなように、金型のみの場合は、内表面温度が 500℃を越え、長時間使用することにより金型材質が劣化し、亀裂、損傷することが予想される。また成形品には図５に示すように割れが生じる可能性が高い。一方、本発明に係る鋳型１の場合は、金型３の内表面温度は 300℃以下で推移しており、黒鉛鋳型２を交換することで長時間の使用が可能であり、また成形品には割れは認められなかった。なお、本発明では、黒鉛鋳型２の寸法、形状、黒鉛材質を適切に選び、また金型３を冷却することによって、成形品の冷却にほとんど影響を与えずに更に金型温度を下げることは可能である。

【００２１】なお、上記実施例では、最も温度の高い鋳鉄溶湯を用いた溶湯法による例を説明したもので、溶湯法より温度の低いレオキャスト法やチクソキャスト法によるダイカストへの適用は充分可能である。

【００２２】

【発明の効果】以上説明したように、本発明に係る鋳鉄のダイカストに用いられる鋳型によれば、金型に対する熱負荷を大幅に軽減でき鋳鉄溶湯は元よりレオキャスト法やチクソキャスト法による鋳鉄のダイカストが可能になる。また、黒鉛は安価で機械加工が容易であり、金型の熱負荷のかかる場所に黒鉛を設けてキャビティを形成するので、高価な金型の寿命が長くできるとともに金型種類の削減が図れる。また、ダイカスト中のセメンタイト組織の生成が抑制でき割れの少ない鋳鉄製品を製造す

ることができる。

【図面の簡単な説明】

【図１】本発明に係る鋳型の説明図であって、ａは本発明に係る鋳型の全体斜視図、ｂは本発明に係る黒鉛鋳型の斜視図である。

【図２】本発明に係る鋳型でダイカストした板状製品の説明図であって、ａは正面図、ｂは側面図である。

【図３】本発明に係る鋳型でダイカストしたときの金型内表面の温度を金型（比較例）と比較して示すグラフ図である。

【図４】本発明に係る鋳型で繰り返しダイカストしたときの金型内表面の温度を金型（比較例）と比較して示すグラフ図である。

【図５】金型（比較例）によって得られた成形品の割れ状況を示す説明図である。

【図６】縦型ダイカスト設備の概要図である。

【符号の説明】

１：鋳型　　２：砂型

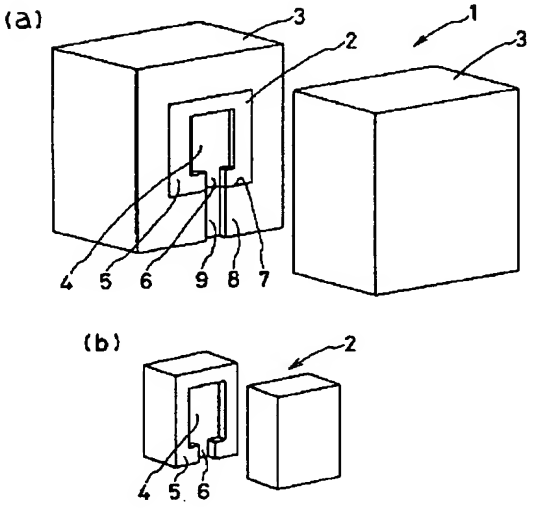
３：金型

４：キャビティ　　５，８：合わせ面

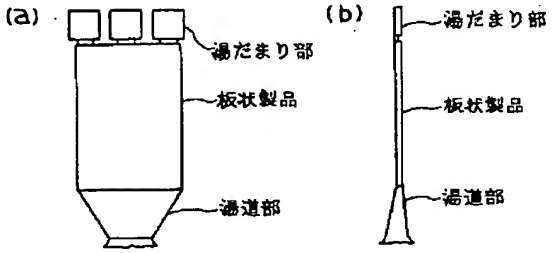
６，９：湯道

７：窪み

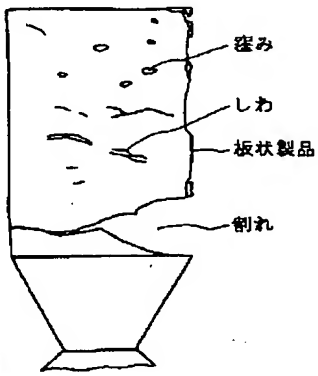
【図１】



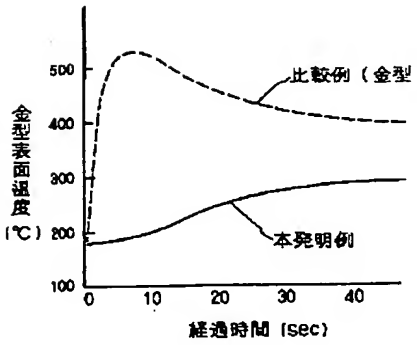
【図２】



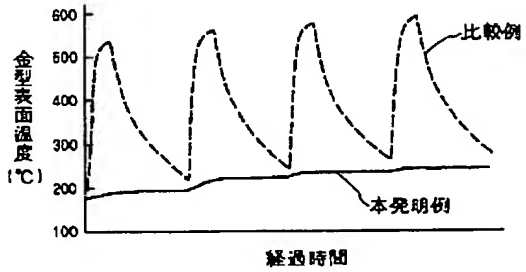
【図５】



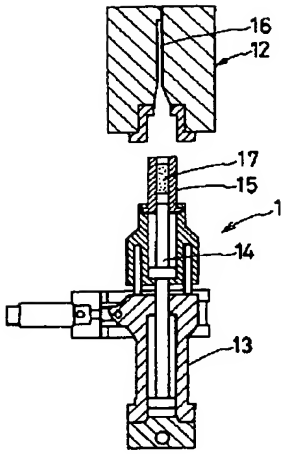
【図３】



【図４】



【図６】



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